

the constancy of the heat of neutralisation of strong acids by strong bases, the introduction of the conception of the *avidity* of acids and bases, and the working out of a thermal method of measuring avidity. In his investigation of solution and hydration, Thomsen paved the way for future work, cleared away many misconceptions, and put the thermal aspects of the questions on a secure basis. It is not yet time to interpret the thermal data concerning the classification of elements wherewith Thomsen has enriched chemistry; but the data are there, established by a most careful and ingenious experimenter. In speaking of Thomsen's work on the thermochemistry of carbon compounds, one has to distinguish between the data and the theoretical discussion of them. The data are sure. Personally, I think his theoretical conclusions are inadmissible.

The tremendous question of chemical affinity was attacked, thermochemically, by Thomsen with boldness. So long ago as 1854 he announced his much-discussed generalisation:—"Every simple or complex action of a purely chemical character is accompanied by production of heat." In 1882 he was not quite so sure, and modified his dictum, asserting that "the great multitude of chemical processes which are accomplished without the aid of foreign energy, and are free from by-reactions, are accompanied by production of heat." This form of the law of maximum work is surely a sound generalisation, but it is purely empirical. Thomsen never thoroughly analysed the concept *chemical affinity*. Affinity is only one factor of chemical energy, as quantity of heat is only one factor of thermal energy. Thomsen's great contribution to the subject of chemical affinity is the mass of his well-established thermochemical data.

It seems to me that the two marks of Thomsen's experimental work are its soundness and its orderliness. There is nothing haphazard, nothing slipshod about it. He worked on a definite plan; he worked with all his might; his work must remain to his everlasting honour.

M. M. PATTISON MUIR.

NOTES.

THE attention of all who are interested in the work of zoological exploration is directed to the expedition which is now being organised by Mr. W. R. Ogilvie-Grant to explore the Charles Louis Mountains of Dutch New Guinea, which form the highest part of the range extending right across the island from east to west. The highest peaks have an altitude of some 17,000 feet. A rich harvest is expected, for until recently the hostility of the natives has frustrated all attempts on the part of European travellers to enter this territory. This hostility, however, has now been overcome, and no effort should be spared by the naturalists of this country to be the first in the field to tap what will certainly prove to be one of the richest zoological regions in the world. Mr. Grant is endeavouring to secure ample funds in order that both the zoology and botany of this region may be thoroughly investigated. If this is to be done, a sum of at least 3000*l.* will be necessary. A considerable portion of this sum has already been generously provided, but more is yet required, and it is hoped that this will speedily be forthcoming. Those who desire to help should send subscriptions to Mr. C. E. Fagan, British Museum (Natural History), Cromwell Road, S.W. The leadership of the expedition has been entrusted to Mr. Walter Goodfellow, who has already done much valuable work in the exploration of New Guinea. To make the more certain of success he will be accompanied by Mr. W. Stalker and Mr.

A. F. R. Wollaston, both of whom have done good work in New Guinea, as well as in other parts of the world.

THE executive committee of the British Empire League is organising a movement to provide London with a monument to Captain Cook. Cook was a man of science as well as an explorer; his hydrographical surveys are excellent examples of the scientific work of our navy, and he contributed also to astronomical and medical science. Last November the British Empire League appointed a sub-committee to promote the object and to form a general committee. We have received a list of the names of distinguished persons who have consented to join the general committee, and these include representatives of Australasia, the Colonial Office, the Admiralty, the scientific societies, the shipping industry, and the Cleveland district of Yorkshire—of which Cook was a native. The general committee will later appoint an executive to collect the necessary funds, to determine the character of the memorial, and to select the best available site. It is estimated that, if the monument be in the form of a statue, 3000*l.* will be needed. Fuller particulars can be obtained from the secretary to the British Empire League, Mr. C. Freeman Murray, Norfolk House, Laurence Pountney Hill, E.C.

ON Monday evening Dr. M. A. Stein read before the Royal Geographical Society a paper on his geographical and archaeological explorations in Chinese Turkestan in 1906-8. We have from time to time noticed Dr. Stein's discoveries while his expedition was in progress. His lecture on Monday evening strengthened opinion as to the importance of his researches, and brought out very clearly the widespread influence exercised by Indian and classical art on Buddhist temple worship throughout Central Asia during the early centuries of the Christian era. Dr. Stein told the story of one important discovery about which until now he has kept a discreet silence. He was greatly desirous of examining a secret store of ancient manuscripts which had been accidentally discovered by a Taoist priest in the Caves of the Thousand Buddhas, south-east of Tun-huang. The priest knew nothing about the character and importance of the treasures he was guarding, but it was only after prolonged discussion that he consented to produce some of the manuscripts for Dr. Stein's inspection. These happened to be fine rolls of paper containing Chinese versions of certain Buddhist texts, which the colophons declared to have been brought from India and translated by Hsüan-tsang, the famous Chinese pilgrim, whom Dr. Stein is wont to call his patron saint. Much impressed by what he regarded as a special interposition by Hsüan-tsang on Dr. Stein's behalf, the priest was induced to show the explorer the secret chamber containing his treasures. These were piled up without any sort of order to a height of 10 feet, and comprised not only written documents, but fine paintings on silk and cotton, ex-votos in all kinds of silk and brocade, and streamers in various fabrics. Dated documents showed that the chamber must have been walled up about 1000 A.D., but some of the records dated back so far as the third century A.D. After prolonged negotiations, Dr. Stein was permitted to make a selection from the documentary and other remains, and filled with them twenty-nine cases, which have now been deposited in London. We hope to return to the subject of Dr. Stein's discoveries at greater length on the publication of his paper.

THE death is announced of Senhor J. Barbosa Rodrigues, director of the botanical garden at Rio de Janeiro, and author of several works on Brazilian flora.

THE guarantee fund for the International Aëronautical Exhibition, to be opened at Frankfurt a. M. in July, amounts to 700,000 marks. Count Zeppelin has contributed 10,000 marks to the fund. It is expected that a sum of one million marks will be raised.

INVITATIONS have been issued by the president of the Royal Society, chairman of the general board of the National Physical Laboratory, to meet the general board at the laboratory, Bushy House, Teddington, on Friday, March 19, when the various departments will be open for inspection, and apparatus will be on view.

THE thirty-sixth annual dinner of the old students of the Royal School of Mines will be held on Tuesday, March 30, at the Hotel Cecil. The chair will be taken by Mr. F. W. Rudler. Applications for tickets should be made to Mr. George T. Holloway, hon. sec. dinner committee, 57 Chancery Lane, W.C.

IN the third biennial report of the commissioners of the Connecticut Geological and Natural History Survey, for 1907-8, attention is specially directed to the scientific interest and economic importance of the peat-deposits of that State. At the melting of the great ice-sheet the surface of Connecticut was dotted over with innumerable lakes and pools, many of which have since become obliterated, some by the growth of peat and some by other causes. Most of these peat-bogs have now been carefully surveyed and sounded, so that the amount of their cubic contents can be approximately ascertained. Peat is used in the State not only for fuel and as a gas-producer (for which it is specially suitable), but likewise as a fertiliser, and, incidentally, for various other purposes.

SINCE the importance of "types" to the working systematic naturalist can scarcely be overrated, the authorities of the U.S. National Museum have set a good example to museum curators generally by issuing a catalogue of all the mammalian specimens of this nature preserved in the institution under their charge. This catalogue, which is published at Washington as Bulletin No. 62 of the museum, has been drawn up by Messrs. L. M. Ward and W. H. Osgood, who appear to have discharged a by no means easy task in a thoroughly satisfactory manner. The number of mammalian species of which the museum possesses the types is very large, but it should be borne in mind that, in addition to real types, the list also includes "cotypes," "lectotypes," &c. So far as practicable, all the type-specimens in the collection have been arranged in special cabinets, a plan which may be commended to the best attention of those in charge of other museums.

THE skull and brain of the horned dinosaurs, Triceratops, with notes on the brain-cases of Iguanodon and Megalosaurus, form the subject of a paper by Dr. O. P. Hay, published as No. 1660 of the Proceedings of the U.S. National Museum (vol. xxxvi., pp. 95-108). Several specimens of the brain-case of the Ceratopsia are available for study, from which casts of the brain itself have been taken, but great difficulty has been experienced in homologising the different parts owing to the fact that the bones of this region of the skull are more or less completely welded together. This has led, in the author's opinion, to several misidentifications, notably in the case of the supra-occipital. The paper is, however, of an extremely technical nature, and without explanatory figures it would be little use discussing the author's emendations and conclusions. Certain amendments are suggested on previous determinations of the component elements of the brain-case in the iguanodon and the megalosaurus.

FROM the study of its crinoid fauna, Mr. A. H. Clark in an earlier paper suggested, with some hesitation, that the entire Australian coast, southern as well as northern, should be included in his "Indo-Pacific-Japanese" region. The determination was based on the fact that all the Australian crinoids are tropical forms, the element of hesitation being due to the apparent absence of the South Australian genus *Ptilometra* from the rest of the region. In a paper on crinoids from the Philippines, published in vol. lii. of the Smithsonian Miscellaneous Collections, the author announces the discovery of the genus in question to the north of the equator, thereby definitely determining the correctness of his earlier suggestion. The new paper is based on a collection of crinoids obtained from Philippine waters by the U.S. Fisheries steam-vessel *Albatross*. This collection includes not only a remarkably large number of new forms, but likewise examples of species previously known only by more or less imperfect specimens.

IN the December (1908) number of the *Annals and Magazine of Natural History*, Mr. R. Kirkpatrick, of the British Museum (Natural History Department), described two very remarkable new types of calcareous sponges, for which he proposed the generic names *Minchinella* and *Merlia*. These sponges bear many resemblances to some of the fossil Pharetronids, and are extraordinarily different from any other living forms. The history of the specimens is curious. *Minchinella* was found in an old bottle of *Challenger* material, still in an admirable state of histological preservation! *Merlia* was represented by some dry and stony-looking fragments which had been given to Canon Norman, F.R.S., by a Madeiran naturalist. Being anxious to investigate the minute anatomy of *Merlia*, Mr. Kirkpatrick recently visited a small island near Madeira with dredging apparatus, and after much hard work succeeded in obtaining living specimens, which he preserved in a variety of ways for minute histological investigation, so that we may expect shortly to have a full account of this interesting genus.

IN *Man* for February Mr. H. C. Brown gives an account of a curious device for cheating death practised in Burma. In this case, after a death in the family, one of the survivors was warned in a dream that the death of a child would follow. Accordingly, a bamboo was cut exactly the length of the body of the child, pieces of his hair and nails were enclosed in it, and the whole, as a representative of the child, was solemnly interred. The device failed to produce the desired effect, the mourners on their return from the mock funeral finding the child dead.

DR. G. F. BLACK, of the New York Public Library, has undertaken a useful but difficult task in preparing a bibliography of the literature connected with the Gypsies. The preliminary draft which he has issued, and for which he invites additions and corrections, is intended to include not only separately published books and pamphlets, but also the vast fugitive literature of the subject, papers in the proceedings of learned societies, reviews, and the like. The British Museum Catalogue, the Berlin *Orientalische Bibliographie*, the Leipzig *Geschichte und Sprache der Ziguener*, and the *Bibliographia* in Colucci's *Gli Zingari* have all been laid under contribution. Even as it stands, this bibliography will be of much assistance to students of the history, sociology, and linguistics of this mysterious race, and it may be hoped that the compiler will receive the hearty cooperation of European and Oriental scholars in bringing it to a successful completion.

MR. SHEPPARD, the energetic curator of the Hull Museum, describes in his annual report for the past year the steady increase of the collections under his charge. Among recent additions in the department of antiquities are a bronze sword, 22 inches in length, found at Leven, near Hull, the largest implement of its class which up to the present has been discovered in that vicinity, and a fine collection of vases of the early English period from the cemetery near South Cave. The order Arachnida has been specially studied by local naturalists, and one of this class, *Erigone spinosa*, from the east Humber bank, is new to Britain. Gifts to the museum of an old pannier saddle and various domestic appliances of the Stuart, Georgian, and Early Victorian periods, now rapidly disappearing, suggest that other provincial museums would be well advised to imitate Hull in forming a special collection of such objects. Mr. Jacobs, chief engineer of the Pennsylvania Railway and Hudson Tunnels Co., New York, has presented to the museum a valuable model, made to scale in brass and steel, of the great tunnel shield used in the excavations carried on under his control. This, in view of a recent scheme for tunnelling the Humber, has proved to be a most attractive exhibit.

MR. E. O. GREENING discusses in "One and All Gardening" annual for 1909 the problem of town gardens for the poor, and describes the experience of the Vacant Lands Association, formed with the object of acquiring waste lands in the metropolis, if only temporarily, to turn into allotments. Thus in Fulham a piece of land comprising seven acres provided space for fifty-eight plots; land was also secured in East London and Balham. The annual also contains a pithy article, by Mr. R. L. Castle, on the French system of intensive cultivation, with a description and illustrations of the gardens worked by women gardeners at Thatcham, in Berkshire.

A SHORT part (vol. xii., part v.) of the Contributions from the United States National Herbarium is assigned to the descriptions, by Mr. H. Pittier, of some new plants from Central America. The most interesting are three new species of *Carpotroche*, a genus of the Flacourtiaceæ, from Costa Rica. The flowers are characterised by their styles and a winged ovary, and the succulent fruit is produced by the development of pulp from an aril-like outer layer of the seeds. The discovery of these species extends the distribution of the genus, formerly known only from Brazil. Another discovery of two new species of *Phyllonoma* (Saxifragaceæ), also in Costa Rica, bridges a gap in the distribution of that genus, which had previously been collected in Peru, Columbia, and Mexico.

IN the *Comptes rendus de la Société impériale des Naturalistes de St. Pétersbourg* (vol. xxxix., part i.) two new epiphyllous lichens collected in the Caucasus are described by Messrs. A. A. Elenkin and N. N. Woronichin. The phenomenon of lichens growing on leaves, except in the tropics, is very rare; a former instance from the Caucasus was recorded by Mr. Elenkin some years ago, and in all three cases the lichens were taken on box leaves. Of the two new species, one, in which gonidia of the *Chlorococcus* type were associated with apothecia, is assigned to the genus *Sporopodium*; the other was indeterminable, as only pycnidia of the fungus were obtained, and the alga, which was intracellular, is doubtfully referred to *Trentepohlia*.

DETERMINATIONS of plants collected by Dr. A. Weberbauer in the Andes supply the main item in the first part of vol. xlii. of Engler's *Botanische Jahrbücher*. Numerous

additions are recorded for the genera *Palaua* and *Malvastrum* (Malvaceæ), *Tibouchina* and *Miconia* (Melastomaceæ), *Schefflera* (Araliaceæ), and *Lantana* (Verbenaceæ). In connection with the recent discussion at the Linnean Society, attention should be directed to the article by Dr. H. Schenck on the phylogeny of the bryophytes and ferns, in which he presents a carefully prepared argument in favour of a descent from the brown algæ, notably from Dictyota. The antheridia and archegonia of these groups are considered to be homologous with the plurilocular gametangia, while the spore mother-cell is regarded as homologous with the tetrasporangium of Dictyota.

THE Deutsche Seewarte (Hamburg) has published its meteorological year-book for 1907, the thirtieth volume of the series, containing observations and results at ten stations of the second order, and hourly readings at four normal observatories. These carefully prepared tables follow the usual form adopted by all the German States, based upon the international scheme, and we note that the gravity correction is now applied to the barometrical observations. As in former years, statistics relating to all storms which have affected a considerable area of the German coasts are given; these are prepared from observations at fifty-seven storm-signal stations, and furnish very useful data for reference; October was the only month in which no storms were recorded. An appendix gives a summary of the contents of all the German meteorological year-books for the year 1907.

THE meteorological statistics of the Colorado College Observatory for 1907, compiled by Mr. F. H. Loud, have been received. This institution has an exceptionally good supply of self-recording and other instruments, many of which were presented by General W. J. Palmer, who has for some years provided for the expense of reducing and publishing the observations. The tabular results are prepared with great care; e.g. the daily means of temperature are obtained from hourly tabulations of a Richard thermograph, and the extremes shown by the maximum and minimum thermometers are checked by the same thermograph. The wind is resolved into four component parts (instead of two), as recommended by Prof. A. von Oettingen, of Yuriev, and others. The mean temperature of the year was 48°·2, no reading being below zero (F.), whereas in 1905 the minimum was -22°. The monthly range was not less than 63° in each of the months February-May; the spring is always a very critical time for cultivation. The rainfall was under 10 inches, little more than two-thirds of the ordinary fall.

AN elaborate series of experiments has been undertaken at the Physikalisch-technische Reichsanstalt, Charlottenburg, the results of which appear in the *Deutsche Mechaniker-Zeitung* for February 1. Altogether 454 single sensitivity tests were made—ninety-six in a water bath at 40° C., 222 in the mouth, and 136 in the arm-pit. By sensitivity is understood the time taken by the thermometers in assuming the constant temperature of the water bath or of the human body. According to the author, Mr. H. F. Wiebe, it would appear possible to increase the sensitivity of clinical thermometers in general, and to manufacture actual minute thermometers to indicate correctly by measurements in the mouth in one or even in half a minute. It seems improbable to make minute thermometers for use in the arm-pit which will take up the temperature of the body in one minute, at least so far as glass thermometers are concerned. In order to obviate errors in this connection, when using clinical thermometers it would be desirable to supply instructions for their use,

in which it should be set forth that in taking measurements under the arm the thermometers should be allowed to lie for five minutes before the reading is taken.

MESSRS. SCHEEL AND HEUSE have published in the February number of the *Zeitschrift für Instrumentenkunde* the results of some investigations undertaken by them on the methods of producing high vacua. The tests were carried out on the Gaede pump, the Toepler pump, Reden and Rosenthal's mercury pump, and on charcoal in liquid air used in connection with the air pump. The resultant pressures were measured by the McLeod vacuum gauge, the authors having found (*Verhandlungen der deutschen physikalischen Gesellschaft*, vol. xi., p. 1) that this method could be applied for the measurement of the lowest pressures. The most important result was that obtained by employing charcoal prepared from cocoa-nut shell, and using this charcoal, in liquid air, in conjunction with an air pump (Gaede's), the initial pressure of 0.006 millimetre being derived from the pump. A vacuum of 0.00001 millimetre was obtained and kept up for some time by this method. Complete tables of readings, and a full description of the experiments, are given in the article.

AN interesting report of trials on a complete steam plant at the Greenvale Mill, Littleborough, near Manchester, is given in *Engineering* of February 26. The trials were made under the direction of Mr. G. B. Storie, consulting engineer, of Rochdale, and his report is of special interest on account of the very full results given. The plant includes a Brush-Parsons parallel-flow steam turbine developing 500 kilowatts at 3000 revolutions per minute and 200 lb. per square inch steam pressure. Mr. Storie finds its thermal efficiency at 91.8 per cent. of the rated power to be 18.27 per cent., the efficiency ratio by comparison with the Rankine cycle being 0.579. It is unusual to find a report on a steam turbine containing information regarding the pressure, temperature, and degree of superheat of the steam at the end of each stage of the expansion, and it would be very useful if other experimenters would take Mr. Storie's report as an example in this respect. There has been a tendency to withhold such information in the past. Special attention may be directed to the following table of results showing the importance of maintaining a good vacuum with steam-turbine plants:—

Barometer, 29.29 inches.

	163	163	164	161	162	156	157	158
Steam pressure at entrance to turbine—lbs. per sq. inch								
Steam temperature at entrance to turbine—degrees F.	524	526	530	530	533	512	528	530
Vacuum—inches of mercury	28.29	27.1	26	25.15	24.05	23	22	21
Kilowatts	275	275	276	275	273	270	270	263
Pounds of steam consumed per kilowatt-hour	18.54	19.63	20.65	21.63	22.34	23.33	23.7	24.25

A PAPER on some recent grain-handling and storing appliances at the Millwall Docks, by Mr. Magnus Mowat, read before the Institution of Civil Engineers on March 2, contained some interesting facts about grain elevators. The installation now provides for the discharge and weighing of 550 tons of grain per hour *ex ship*, and for its delivery either partly or wholly into granary, silo, or barge. The elevators which come in contact with the ship's hold are of the pneumatic or suction type. The granary and silo elevators are of the bucket type, and, like the band-conveyers, are of two-ply woven cotton, impregnated with rubber. These bands have a total length of

2½ miles; they are electrically driven. In the waterway there is a dolphin, alongside which the ship is moored. This is a wooden jetty of greenheart timber, 350 feet by 24 feet, placed 50 feet clear of and parallel with the quay. On its deck are four suction elevators, each of 75 tons per hour capacity, corresponding with the respective holds of the ship. The machinery within the dolphin includes four pairs of exhauster pumps, each 46 inches diameter by 60 inches stroke, which maintain in the grain-receivers on the top of the towers a partial vacuum of 7 inches to 10 inches of mercury. Flexible pipes connect the receiver with the ship's hold, and the grain is elevated to a height of 80 feet by the inrushing air, the proportion of air being controlled by nozzles with adjustable sleeves. The grain separates itself from the air in the receiver, and automatically discharges through "tipplers" at the bottom of the chamber into hoppers which feed the weighing machines. These deliver through steel shoots into barges, or connect with the quay by band-conveyers on bridges spanning the intervening water-space. The band-conveyers within the granary and subways under the quay are endless, and are supported at 6-foot intervals by steel rollers on cast-iron standards, tied longitudinally by steel angles on each side; their speed is 552 feet per minute. The bands and elevators form a series for mechanically conveying the grain from the dolphin elevator to the roof of the granary, from which it is distributed to the various floors by gravity through pipes provided with sleeves and doors for housing and delivery to or from any section.

WE have received from Messrs. John Wheldon and Co., of Great Queen Street, London, W.C., a copy of their latest catalogue of geological works, containing particulars of 1761 publications they have on sale. The books concerned include selections from the libraries of the late Prof. Ramsay, Dr. R. Hunt, Prof. J. Percy, Prof. Phillips, Mr. William Topley, and Dr. Flight.

MR. FRANCIS HODGSON has published the sixth volume of the second series of the Proceedings of the London Mathematical Society. The record deals with meetings of the society held from November, 1907, to June, 1908, and the papers read on these occasions, short abstracts of which have appeared already among our reports of societies and academies. The volume also contains obituary notices of the late Lord Kelvin and Mr. C. Taylor.

OUR ASTRONOMICAL COLUMN.

ANOMALOUS REFRACTION AND SPECTROHELIOGRAPH RESULTS.—Having spent some time, in August, 1907, at the Mount Wilson Observatory, and having employed the splendid equipment there in a number of experiments, Prof. Julius has derived further confirmation of his theory that some of the phenomena seen on various spectroheliograms are, at least in part, due to the anomalous refraction which waves from the vicinity of absorption lines must suffer when passing through an absorbing medium of varying densities. The experiments and the results obtained are described and discussed in No. 5, vol. xxviii., of the *Astrophysical Journal*.

By selecting lines at different distances from the sodium, D, lines, and passing the rays through a tube containing sodium vapour, in which the density gradients could be controlled, Prof. Julius was able to obtain photographs showing the effects of anomalous refraction, and he shows that equivalent conditions probably exist in the solar atmospheres. Should the further work which is to be carried out on these lines prove confirmatory, it will no longer be necessary to explain "dark" and "bright" flocculi by the assumption of very marked differences in the absorbing and emitting conditions of a certain gas or vapour in contiguous regions on the sun, for the anomalous refraction